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Section I

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Principles of Punched Card Accounting

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Principles of Punched Card Accounting

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EDITORIAL DEPARTMENT NOTE

There are many ways of handling accounting data, both manual and mechanical, and in given instances either of these broad methods will do an adequate job. In the mechanical field there are many different types of machines involving the application of a number of different mechanical ideas. Our Bulletin this time deals with a survey of the methods and applications of one kind of mechanical equipment, punched card accounting. The Bulletin describes the application of this equipment to a number of different industries and gives in addition substantial information concerning the mechanics of handling accounting data on punched cards. Those among our membership who are interested primarily in the results to be accomplished by an accounting department, will be interested in the application of this method, while many of our members who are involved in the details of working up information will welcome the chance to study the mechanics of the method.

There are two large companies manufacturing this type of equipment and each of them endeavors through its research department to adapt this method to various accounting problems. These research departments often devote considerable time to the study of whole industries and individual companies within those industries. We present the materials in this issue, not with the thought of solving the accounting problem of any member, but rather with the desire to bring to the attention of all members the adaptation of punched card accounting. We hope to present similar bulletins in the future dealing with other classes of accounting equipment.

Mr. Floyd H. Rowland is a native of the State of New York and has long been interested in the field of mechanical accounting. Prior to 1919 his industrial experience dealt with research matters, first with the New York Bureau of Municipal Research and later with the Provident Loan Society. Since that time he has been devoting his efforts mainly to the betterment of the methods both as an executive within businesses and as an industrial engineer. He is at present connected with the firm of Stevenson, Jordan & Harrison of New York, as a specialist on the installation of punched card accounting.

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PRINCIPLES OF PUNCHED CARD ACCOUNTING

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PRINCIPLES OF PUNCHED CARD ACCOUNTING

Introduction

Regardless of whether it is an N. A. C. A. meeting, a luncheon group or a conference in some company's office, the conversation frequently gets round to the subject of punched cards. Various opinions are expressed, based upon the experiences of those present. It has frequently been my observation that these opinions indicate that this subject is not fully understood. Punched card methods seem to be surrounded by a great deal of unnecessary mystery, despite rapid strides in machine development and increasing scope of application.

We find that very little is being done in the development of this new tool, except here and there by executives who have come to view this subject from the broadest angle and through the medium of a few engineers and some of the more experienced machine card salesmen, who are pushing forward the investigation of the real possibilities of punched cards.

Strangely enough, there is not in existence either in book form or in publications of the companies who manufacture these cards and the machines using them, any presentation covering their application which might be termed a "Handbook" to guide an executive in determining the possibilities for his own company. The information which is available is found either in advertising literature or in booklets which cover specific topics. It does not present the whole subject of punched card accounting.

Therefore, the writer has felt it desirable to attempt to perform a service by presenting in a single publication a condensed but comprehensive survey of the more generally used applications, not from the aspect of a machine but rather from a result standpoint and to develop what would correspond, on other subjects, to a reference manual on punched card methods with the fond hope that this may bring about a new conception of the punched card method and lift the entire matter from the field of machines to its true place as a means of management control.

It does seem desirable at this point to stress the fact that none of the methods prescribed have involved changes in business to suit a method but they will always be found to develop organization procedures as they exist even though punched cards have never

been considered. I have yet to find the necessity for any radical changes made merely for the sake of punched cards which should not have been made for the good of the business if punched cards had never been considered.

How to Determine Activities to Which Punched Cards Should Be Applied and the Factors To Be Considered In Designing Such a System and in Weighing Results Obtained Against the Cost in Obtaining Them

One of the first cardinal principles to be kept in mind is that it is practically never economical to use a punched card which is only going to be sorted once or twice for report purposes, that is to say, where practically only one distribution is made. If the cards are not going to be used more than this, then it would be found less expensive to use some other method.

It should be borne in mind that every tabulating installation entails a rental cost. This depends on the quantity and style of equipment used. There are several factors to be considered in conjunction with any tabulating installation, any of which may aid the executive to arrive at a decision. Will the punched card method provide for more prompt completion of reports through the substitution of machine methods for manual operation? Will accuracy be obtained by supplanting the human element with mechanical aids? Will the reduced personnel plus cost of machines result in a net financial saving over previous methods? Consideration should also be given to determine what additional analysis of value to the executive may be incorporated in the punched card procedure. By weighing all of these factors the executive should be in a position to determine whether or not the machine method will work to the benefit of his company.

It is not possible to cover in this section of the pamphlet all possible fields for suitable application of this method in definite lines of business but an attempt will be made to do this in a subsequent section for manufacturing and a few other major classifications of industry.

The first thing an executive will find in looking at his own situation for punched cards is that he needs to know a great deal more

about his own business than he has known heretofore. When he acquires this information, he is going to feel compelled to investigate many phases of it immediately to determine why it exists in the particular form in which he finds it and to what use it is put and what is done with all of the reports compiled. For example, in an investigation of part numbers, finished stock, etc., he probably will discover that a lot of cumbersome identification numbers are being used, running into an unnecessarily large number of figures, combined possibly with letters or fractions, so that one practically has to be born in the business to be able to understand them. The thought should immediately occur to him that such numbers should be simplified and part numbers should be made up in such a manner that at least some of the digits of the number indicate at least some of the specifications of the article. I know of a case where it takes a combination of thirty-two letters to serve as an identification of an item, not to mention another ten or fifteen to describe its fittings, whereas intelligent coding should result in the use of a six digit number and not over three figures for the fittings, each digit of which may indicate possibly a portion of the specifications and can be learned readily by all of the employees who have occasion to use them. Until the time the mechanical tabulating method was considered, the question was never raised in this industry and they were continually using all of these detailed descriptions in their factory, stock and customer records and statistical records, not to mention on their customers' invoices.

On the question of the chart of accounts, the executive probably will find that this has been built up as a result of a natural growth and the code numbers used to identify the accounts were absolutely meaningless and unrelated to rhyme or reason. Another condition frequently found is the use of three or four different classifications of product for manufacturing or sales purposes, not to mention trade association requirements, whereas one intelligent code should serve all purposes.

Another type of information which the executive will be requested to secure will be data relating to the number of items carried in stock and the maximum quantity of each of the units or packages involved. This probably will bring up many questions leading to a study of shipping units and re-packing, a fruitful

source of wastage in many companies at the present time. Methods of stock-keeping probably will bear investigation as well as the handling of returned merchandise from the customer or from the factory to process. He will be required to secure such data as to number of invoices per day, the average number of items on each and the number of shipping units per item, the allotment of salesman's territory, etc. all of which will lead him to a scrutiny of the results obtained and open up an entire new line of investigation. In other words, he will discover that in the proposed design of a punched card method, he must investigate and become thoroughly conversant with every phase of the entire business. He will also be called upon to go into the question of expense and performance in various clerical activities and the use to which reports are put. It has been a very frequent experience to have an executive say that when he had gone through the procedure of preparing a punched card plan, if he got nothing else out of it, he certainly learned a lot about his own business.

It would be unfortunate if these remarks were interpreted to mean that the amount of preparatory work required to install a tabulating system is insurmountable and of staggering proportions. Such is not the case. An active executive, however, will find real enjoyment in reviewing the questions brought out at this time.

Applications for Manufacturing Plants

It is, of course, not practical to prescribe the exact applications for any one manufacturing plant in a pamphlet of this character. The nature of each individual business is such that its own special requirements have to be studied and a plan devised to meet these requirements. There are, however, certain general applications to which punched card methods may be applied and the executive will have to determine in his own special case which application may be applied, taking into consideration the nature of his business, the type of product, the process involved and the volume of detail required to handle each product.

Production Payroll System. The first step under the comprehensive plan for manufacturing is the use of the tabulating card as a work order issued by the production department to the specific producing department where the work is to be done. One of these cards will be issued for each operation to be performed in each

department. The face of the card will be designed as any form to carry the written information necessary to get the work done, such as the specifications, order number, quantity, operation number, etc.

The card illustrated as Form No. 5 (see page 1438) is a card used by a plant manufacturing woolen blankets. It is one of four cards required to carry all of the work orders of this company. The punching fields are the same on all cards although to provide suitable writing space for the different kinds of production data, four cards are used, each with its own special headings for the written information. It will be noted that the small figures printed in the writing fields are keyed in with similar fields for punching purposes as a guide to the punch operators. Such parts of these cards as carry similar specifications may be gang-punched and specially punched for the balance of the data.

It is practical in many plants where standard costs are used to punch into these cards predetermined standard overhead, standard hours and standard money for use not only in guiding the foreman but also to have this data available for comparison with actual when reports are run.

These cards are released to the foreman of each department sufficiently in advance of the time they will be required as to be available before the work is started for any given operator. It is assumed that some type of production schedule system is in use which will enable this to be accomplished satisfactorily.

The foreman of each department will need some type of file or rack in which to keep these cards. To be specific, let us assume that he has a rack with three pockets for each machine, the lowest containing the card for the job being worked on, the next highest, the card for the next job to be worked on—and for which the material is available and the third card for which the material is not available as yet. On a hook in front of the box is hanging a brass check bearing the number of the employees assigned to that specific machine that day. If desired, starting time either can be stamped on each card with synchronized time clocks or written by hand. These cards are completed and sent into the office and punched, the employee number, hours, earnings, quantity, etc. having been added by the foreman or clerks to the data previously

written on the card when it was issued by the production department.

After punching, the cards are ready for tabulation of payroll summaries. From these summaries, the payroll earnings are punched in the "In and Out" cards, also tabulating cards, which the employee has used to ring "In and Out" time during the week. This "In and Out" Card is then sorted in with pre-determined deduction cards and the net payroll tabulated. The deduction cards referred to are deductions for welfare dues, rent, community chest, etc. which re-occur each week, the same cards being re-used each week. The "In and Out" Card can be used as a check if desired and given to the employee. Although the illustration does not show one used for this purpose, it is entirely practical to design it in such a way that the banks cancellation stamp will not mutilate the punching information. If used as a check, the process of balancing the bank statement becomes relatively simple. The "In and Out" Card can then be filed away by employee and tabulated periodically to form a statement used for permanent income tax records. (See page 1440.)

The payroll summary, previously mentioned, from which the payroll amounts are punched into the "In and Out" card, can print each card if it is desired and thereby become a complete detailed earnings record after the cards which ran it are destroyed, if this is desired as a permanent supporting payroll record. It is questionable whether this is at all necessary in most cases.

In the use of the "In and Out" Card for tabulation of the actual payroll, either of two procedures may be followed depending upon the type of tabulator. With one of the mechanical type tabulators, using the alphabetical machine, name cards may be prepared for each employee and re-sorted in each pay period. These cards will spell out to the extent of twenty letters the name of the employees in the same manner as though typed.

Where the non-alphabetical straight numeric mechanical tabulator or the electrically actuated machine is used, after the payroll is tabulated on the tabulator, the payroll sheets are run off on an addressograph or stencilling machine and the name of the employee stencilled on the payroll sheet. There is no difficulty in getting the proper stencil opposite the right employee, due to the complete

synchronization of the stencil file and the tabulating cards, in addition to which is the additional assurance derived from the fact that its accuracy can be checked by glancing at the employee number printed by the stencil on the first line of each payroll sheet and comparing this with the pay number printed by the tabulating cards.

There are at least three other uses for the detail job cards. The first of these is labor distribution, a type of record in such common use as to require no further comment. The second use is that of compiling production reports. The same four cards mentioned in the appendix are tabulated for seventeen different production reports for as many different departments. With the exception of a few production reports covering detail material clearances in smaller subdivisions than those which appear on the job cards, it usually will be found that no production reports are necessary other than those which can be obtained from the cards.

The third use of these cards is that of feeding the cost system by supplying the entries so necessary for a standard cost system through tabulations of actual and standard labor, hours and money as well in some cases of standard overhead. There are, of course, unlimited variations in this method, which incidentally may be started at any point of the line. One of these covers the questions arising where employees work in a gang. This, in brief, is a picture of a complete continuous payroll system.

Raw and Material Supplies. One of the most important applications made in this connection is the maintenance of raw stock balances by means of punching debit and credit cards, which, when tabulated at the end of the month, automatically result in the tabulation of outstanding balances. Frequently this is accomplished by punching two cards for each item on each receiving memorandum, one of these cards being filed in the raw stock as a debit and the second, a duplicate, being used for purchase analysis and related records. The credit cards originally may be the stock requisitions themselves, designed to provide the necessary information. Ordinarily, it will be found that the requisitions and other media which result in credits to raw stock or supply stores involve more than one item and cards are punched from the requisitions, perhaps again in duplicate, one being filed in the stock file to tabulate as a

credit and the other to be used as a detail analysis of issues. These second cards are used largely because the first one filed in the stock file is not available at the time these reports are required. The second card may also be used as a debit to work-in-process. Whether or not stock balances are calculated directly or require manual subtraction is governed by the use or non-use of complements. It is, undoubtedly, only a short time before direct subtraction machines will eliminate the use of complements.

Here the question of the form of report rendered is important. Due to the fact that generally stock numbers are the means of identification, the question of the use of the addressograph or alphabetical name card does not arise.

Accounts Payable. It would appear at first glance that in punching cards from receiving memorandums, a basis had been set up for accounts payable records. This conclusion would be proper were it not for the fact that the accounts payable card must be for the total of an invoice rendered rather than for individual items. There are three major accounts payable plans which have been installed as a means of handling this phase of records on punched cards.

The first of these has as its basis the use of a typewriter keypunch, writing the accounts payable register on the typewriter with the tabulating card created as a by-product and used purely for distributive purposes. The ordinary mechanically operated punch is wired to the typewriter and the card dies are set as the typing progresses.

The second type of accounts payable application causes the punching of the card from approved invoices and again used merely for distribution and collection of cards against specific accounts.

The third general and most frequently used type of accounts payable plan provides for the punching of a card for each invoice as received and the maintenance of these outstanding charges in an "unpaid" file, the final transfer of these cards to the "paid" section of the file and their ultimate use for distribution of cards to the various accounts.

The only accounts payable or voucher register maintained currently is the card file itself. If desired, at the end of the month,

this file can be tabulated and in this manner create an accounts payable or voucher register.

Central Accounting Plan for Expense Distribution. The accounts payable card, regardless of how originated, should be designed for tabulation as a part of the complete system of distribution of all accounts, whether originating from accounts payable, factory, sales or other expense charges covering the entire general accounting plan. In a report run from cards such as these, either the alphabetical mechanical tabulator or the addressograph should be used to print the account names eliminating labor in decoding and all balances should be calculated net, automatically. One point to be stressed in preparing cards to net reports is the fact that the preparatory work is performed during the month rather than necessitating a lot of subtraction at the end of the month when the report is needed in a hurry.

Sorted in with these general accounting cards may be placed budget cards, so that all reports when tabulated will show actual figures against budget figures. An example of this type of report is found in an analysis of a branch sales expense, showing each item summarized for the current month, year to date against current months budgeted figure as well as an annual budget figure.

In designing the central accounting plan, it will be found that a careful study of the chart of accounts and its codification will be necessary not only to iron out the kinks in the manner of handling the entries but also the use of a scientifically constructed account number will greatly simplify the system in operation.

Finished Stock. There are two basic plans for the maintenance of finished stock records, (1) The Unit Card Method and, (2) The Debit and Credit Plan.

1. *The Unit Card Method.* The practicability of the Unit Card Method depends upon many factors among which the most important are the standardization of shipping units and the value per unit. The method necessitates the creation of the card for each shipping unit such as a pair of shoes, a box of bottles, packing, etc. It may be necessary to create unit cards as representing multiple units of various quantities, so that we might have a card for one gross of bottles of a particular kind, a second for 50 gross and a third for 100 gross, if these happen to be the most frequent

shipping units or multiples of a unit. These cards are pre-punched and placed in the inventory file upon receipt of the production memorandum or receiving slip to finished stock.

The cards should contain the various specifications of the product, the standard cost and, where the retail price is fixed, the price per gross as well as the extension of this amount by the number of gross or units represented by the card. Where this card is later used to actually write the bill, it will be necessary also to punch in the card miscellaneous data, such as packing, price per gross and, perhaps, the name of the product where this is required on bills.

These cards are filed vertically in inventory files specially designed for this purpose. These files are about the size of an ordinary flat top desk and contain twenty-four rows of pockets, the depth of each pocket being a convenient length for a girl to reach standing in front of the tub. The following illustration will give a better idea of the appearance of the tubs.

This design is the result of experience where high speed pulling is required on production jobs. The cards are arranged in these files behind major guides, usually made of aluminum and sub-

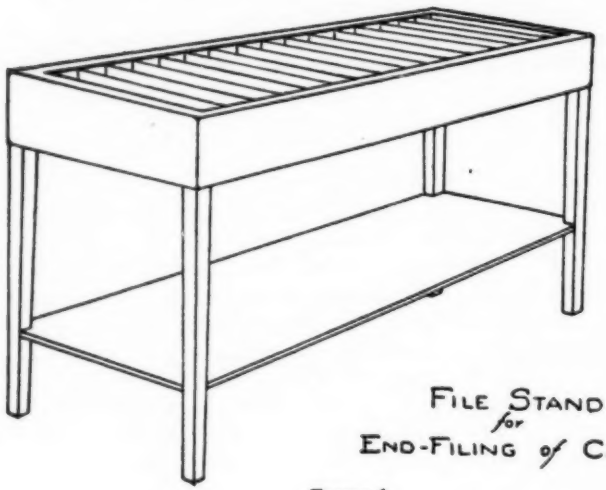


FIGURE 1

indexed, if this is required, by sub-indexes of bristol board. It is quite important that the arrangement of these files be in the same sequence as the stock-room and in accordance with a numerical style or item punched in the cards so that if the cards are sorted by item they will be in the same sequence as the file.

In some types of business where there are large quantities of the same commodity or stock item, it may be desirable to print a serial number on top of the card at the time of punching so that it is possible to determine quickly the stock on hand by subtracting the first and last serial numbers, thereby eliminating the necessity of tabulating. These tubs do not necessarily require follower blocks, but spacing can be obtained as satisfactorily between each commodity by placing small wooden blocks about one-eighth inch in thickness and one-half of the height of the cards, between each commodity in the file.

The insertion of these cards in the file, of course, creates a debit to finished stock. The next step is to create the credit to finished stock, this being effected by the removal of the proper number of cards from the Inventory File. This may be brought about in either of two ways. The first of these contemplates the use of the cards after removal from the inventory file for statistical purposes only, while the second plan provides for the use of these cards for billing purposes and then for statistics.

Under the first plan, copies of the customers' bills will be received by the inventory file clerk who will extract a suitable number of unit or multiple cards from the inventory file, the quantity corresponding with the quantity specified on the invoice. In cases where the price varies, it will be necessary to punch the retail price on the cards along with the various code numbers governing distribution, which latter phase will be discussed subsequently. Where the retail price is fixed, it is only necessary to punch distribution codes. These cards then will be tabulated, of course, and balanced against the accounts receivable total by customers ledger, thereby effectively tieing in deductions from inventory with the financial controls of the accounts receivable statement.

In many lines of business, it is entirely practical to extract unit cards from the inventory file from the customer's order, to insert these cards in the tabulator and print the customers bill. In the

event that this is done, space must be provided on the cards for the purely descriptive information which must now appear on the bill. It is quite common practice to find that there is a complete lack of standardization as to descriptive information appearing on the customer's invoice. In one case that I have in mind the matter is so exaggerated as to require four lines of typing to describe one item due to the fact that the entire specification of the item was written on the bill, no item number being used. If the retail price varies and has not previously been punched in the cards, this must be done before the invoice can be tabulated.

It also is possible that it will be necessary to punch a freight card which will be deducted from the total of the merchandise items to show the net total of the bill. When a tabulator will be designed which will take cards punched with the list price and which will calculate the deduction and automatically print the net of the items on the bill is uncertain at this time, but such a development is sorely needed.

A shipping and packing copy of this invoice should go out to the stock room and there be used as a means of selecting goods from stock. Here again, it becomes apparent that to save the double tracking to the stock room, merchandise should be listed on the invoice in the sequence in which it is kept in stock.

Customer's address and shipping instructions should be placed on the bill by means of an addressograph stencil. Another procedure accomplishing the same result provides for the tabulation of invoices in a single copy, and then adding the name and address, together with instructions, a suitable number of copies being made by hectographing.

The use of these cards after they have been withdrawn from finished stock will be discussed further on the subject of statistics.

2. *Debit and Credit Finished Stock Method.* There are many instances where, due to the small monetary value of the individual item of merchandise or to the lack of standardization of the shipping unit, it is not possible to have a unit card either corresponding exactly to the unit of stock or to fictitious units which can be pulled from the inventory tubs, corresponding to shipments. Even in instances where it is possible to get a definite shipping unit, it frequently happens that the monetary value of the unit is so small

that, from a cost standpoint, it is not practical to use a unit card. In this instance, a debit card will be punched, covering the total receipts to finished stock, one card being punched for the total receipts of each different item. This card will be placed in a "holding" file until the end of the month. During the month, cards will be punched from the invoices covering the total number of units from each item on the invoice. These cards will be punched showing the actual quantities both in positive figures and in complements. At the end of the month, these cards will be sorted in with the debit cards and a finished stock report run showing the net balance on hand automatically calculated.

Accounts Receivable. The application of punched card methods to accounts receivable, including time payment plans, is rapidly becoming widely extended. The following is one of the methods used successfully, and has been included as illustrative of this phase of punched card accounting.

ONE HUNDRED DIVISION

1–A	2–Al	3–An	4–Ar	5–B
6–Bar	7–Be	8–Ben	9–Bi	10–Bl
11–Bo	12–Br	13–Bro	14–Bu	15–C
16–Car	17–Ch	18–Cl	19–Co	20–Coo
21–Cr	22–D	23–De	24–Di	25–Do
26–Dr	27–E	28–Em	29–F	30–Fl
31–Fr	32–G	33–Ge	34–Go	35–Gr
36–Gri	37–H	38–Han	39–Has	40–He
41–Hi	42–Ho	43–Hom	44–Hu	45–I
46–J	47–Jo	48–K	49–Ki	50–Kn
51–L	52–Le	53–Li	54–Lo	55–Lu
56–M	57–Mal	58–Mas	59–McA	60–McG
61–Me	62–Mi	63–Mo	64–Mu	65–N
66–Ni	67–O	68–P	69–Pe	70–Pi
71–Pr	72–Q	73–R	74–Re	75–Ri
76–Ro	77–Ru	78–S	79–Sch	80–Schn
81–Se	82–Si	83–Sm	84–Sn	85–St
86–Sto	87–Su	88–T	89–Ti	90–Tr
91–U	92–V	93–W	94–Wam	95–We
96–Wh	97–Wi	98–Wils	99–Wo	100–X–Y–Z

TABLE I.

The plan requires the use of a ledger number or code number for customers, the kind of code contingent upon the individual requirements. It has been found advisable in practice to use alphabetical numerical code numbers which make it possible to sort numerically on the sorter and produce, as a result, a sequence which is practically alphabetical. The following one hundred division alphabet gives a brief idea of how this is done, although in actual practice it will probably be found necessary to use a thousand or more division codes such as can be obtained from the large filing equipment manufacturers.

The whole question of customer's coding is a very important one in that it has a definite bearing on the ease with which cards are sorted. It may be found that customers should be coded by towns, states, territories or even by branches. Each company's requirements must determine this. After complete codes are established, addressograph stencils should be cut for each customer for later use in heading up statements.

In order to make the application more specific, the routine involved will be outlined only for one type of equipment.

A set of two master code cards are punched for all customers in the ledger for such items as account number, state, city, town and customer, after which they are addressographed and two separate alphabetical files are set-up to enable two operators to use them simultaneously. A tab card is then punched in like manner and the credit rating shown on the tab.

Invoices are received in ledger order with control totals and cards punched, the code card duplicating the codes and the balance of the information punched individually, the amount of the debit also being punched in the balance field. Since substantially the same information is required for both accounts receivable and sales, both accounts receivable and sales cards are punched for each invoice. The sales cards are filed in "holding" files until required for report purposes.

The accounts receivable cards are tabulated for totals of debit amounts and balance fields, which totals are checked with the adding machine tapes originally supplied. After the operation, a control total is punched for the accounts receivable totals and this card filed in the front of the card ledger. The individual accounts

receivable cards are then filed behind their corresponding tab or index cards, at the rear of any cards which may be already in the file in order to insure proper date sequence.

As payments are received, the proper debit cards will be withdrawn from the open file and a control hole punched, indicating payment. The hole will prevent the figure of the debit from printing from the balance field and cause it to print as a credit, thereby eliminating the use of complements.

These cards will then be filed in the "open" file. Partial payments will require the punching of a new card for the amount of the partial payment, both in the credit field and in the balance field, the latter in complement. After tabulation of statements and ledger sheets, the paid items will be sorted out and the balance of file held until next month. Discounts can be punched in a special field and hence included in all tabulations. This column plus credits equals cash receipts.

Sales Statistics. The tabulating machine has had a more universal use in the field of sales analysis than in any other phase of records. It is the first application which comes to the mind when an executive is considering the possibility of using punched cards. Many companies confine their punched card systems entirely to these applications, with the result that very frequently, in times of depression, they suddenly decide that no further sales statistics are required and discontinue the whole business. The little matter of change from tabulating methods to manual methods is an annoying procedure and, if the installation had been justified in the beginning from an expense or a result standpoint, should never occur. In fact, a period of depression should be the time of greatest use for a properly designed sales analysis system.

The reason for the uncertain fate of sales analysis systems lies in the fact that these methods have, in many instances, only ground out statistics of past performance. The information, even though quickly tabulated, requires decoding of code numbers, comptometer work for addition of to date figures and prior year figures and finally, the typing of the entire report in order to get it in shape for executive use. This meant that the usual practice was to run off current month's figures as early as possible in the ensuing month and then, at a time when everyone is sitting around waiting

for reports, start the job of decoding and addition of to date figures. This, of course, requires several days and furnishes fuel for the argument that the reports are so late when issued that they really are not of any use. Cards should be designed so that the current month's cards will accumulate both current month's figures and to date data as well. Last year's figures also should be supplied by master cards on the same reports, in adjoining units, if there is room, and if not, on the next line of the report. These, likewise, should be split into the current month and year to date.

The decoding of reports is, in most cases, an absolutely unnecessary operation. This can be avoided in either of two ways; (1) By use of alphabetical name cards which print the names or words directly from the tabulating card or, (2) by use of a synchronized stencil file under which plan stencil files, kept in a predetermined sequence, and synchronized to tabulating code cards and tabulating spacing (from single line spacing to triple, etc.) can be used to print names on reports, at a high rate of speed. The extent of the possibilities of this latter method is indicated by the fact that one user utilizes a customer's stencil file of 35,000 stencils to decode sales reports for customer's names, salesman, branches, etc.

The use of these plans means that a great deal of work, ordinarily performed at the end of the report period, is done the early part of each month, when the rush is over or, in the case of decoding, performed once and the task is finished.

The usual sales analysis installation is only partially effective due to the fact that the reports show only actual performance. This, of course, tells the story of what has happened but yields no clue to what should have occurred. The only comparison available is usually the comparison with a prior year or years, which comparison may or may not be of value. It is, therefore, highly desirable to budget sales, not only in total but down the line through sub-divisions such as branches, salesmen, and in some lines of business, the more important customers. If the business is one which can be subdivided readily by departments, it may be advisable to do this also. It is not practical within the confines of this pamphlet to develop the method of setting the budget. That is a subject in itself.

Product budgeting, and, in fact, statistics of products, may be

essential in some lines of business but for the purpose of simplification it is assumed that it is not essential to go that far.

At the time the tabulating cards are punched, either prior to invoicing the customer or afterward, each card should be punched with a profit classification number. If there are several sales divisions or departments, there may be from one to a dozen profit classes in each, although ordinarily four or five are sufficient. This profit class is indicative of the desirability of sales from the standpoint of gross profit based on list price, manufacturing conditions, etc. The budget should, of course, carry through to this profit classification.

It now becomes possible to run reports by branches, sales divisions and profit classes showing actual shipments or sales against budgeted data or standard sales performance. The first time this report is run, an explanation of the difference between budgeted sales and actual sales will be required. The usual explanation has been that it indicated loss of volume and was somewhat affected by price cutting. The extent of influence of either factor was indeterminable. The next question, logically, is how much were the gross profits affected through the price cutting, loss of volume and also by the fact that too great a volume of low profit class merchandise, (trade leaders priced on close margin and easy to sell) had been sold.

To answer this question, it is necessary to include standard cost in the cards. With this additional information, it is possible to determine the full story, not only to explain the variance between sales budget and actual sales but also the effect on profits, due to price, volume and "mix" of profits classes. This means that, in effect, profit and sales coverage standards have been set. If the picture of branch, sales division, and profit classes checks up satisfactorially, there would be no apparent need for a further breakdown of the figures. Certainly, for some little time after such a system was started, there would be plenty of divisions out of line without bothering with those which check properly in the aggregate.

Needless to say, this type of report discloses territories where the proper profit is being obtained but where volume is off and in other cases will show that certain territories perhaps might be

covered better by a salesman rather than a branch office. The old practice of paying the salesmen on total volume will soon be found hopelessly inadequate and profit classes will be the new basis.

In speeding up codification, it has been found of considerable advantage to use pre-punched code cards which duplicate codes in sales cards, thereby eliminating possibility of errors.

Depreciation. One of the simplest installations made with punched cards is that which relates to depreciation and the plant ledger. The task of originally setting up the records may be a considerable one but when it is once established, the work involved is practically nil. Depreciation may be carried in any one of or all of three bases such as; Income Tax, Replacement and Obsolescence. For purposes of this pamphlet, it is assumed that only one class of depreciation is to be carried. The attached illustration shows three machines purchased in three periods, in the earliest of which sixty periods have already expired, figuring each period as a month. In starting the system with the information at hand as to cost and the rate of annual depreciation, the monthly depreciation will be calculated. It is then necessary to step up the cost value of each machine to a factor value which is really the annual depreciation figure in that particular month at the depreciation rate per month or period times the number of periods which have expired since the date of the first machine with which the record is started. For purposes of this method, the term "period" is used to refer to month and the number of expired periods will be those from the date of the acquisition of the oldest machine or the starting of the system. At the time the record is set up, therefore, all cards will be punched with the period of acquisition and also with the expiration period which will be the number of months from the first period to the actual expiration date when the depreciation will have been written off on each individual machine, etc.

This method makes possible, through automatic sorting, the withdrawal of cards covering completely depreciated equipment for which cards should be withdrawn from the file. In operation, this means the addition of new cards for additional fixed assets as they are acquired and the tabulation of the file periodically plus the removal of the cards for the depreciated assets. The formulas for

DEPRECIATION RECORD

Date Acquired	Original Cost	Annual Depreciation Rate	Monthly Depreciation	Factor Value	Period Expired	Book Value
1/1/25	$1200.00	10%	$10.00	$1200.00	120	$600.00
1/1/27	2400.00	5%	10.00	2640.00	264	2040.00
1/1/29	1800.00	10%	15.00	2520.00	168	1620.00
1/1/30	$5400.00		$35.00	$6360.00		$4260.00

Verification

$5400.00	Cost	$35.00 per month X 60 expired
4260.00	Book Value	periods—$2100.00
$1140.00	Depreciation Reserve	
$6360.00	Factor Value	
2100.00		
$4260.00	Book Value	

the calculation of depreciation are not included as a part of this pamphlet which deals only with the card handling procedure.

The calculation of book value must be performed for each machine as of the date of the start of the system, but afterward departmental totals of book values can be obtained without individual figuring. The book value figure shown in the illustration is a hand posted figure.

Status

No mention of a tabulating system would be complete without reference to the status method of using tabulating cards. This plan is chiefly remarkable, because of the amount of data brought together on one report from different types of cards and the ease with which it is completed.

There are many forms of status systems but the one usually found of greatest use presents the picture of inventories, work-in-process and the status of orders. Such information as the following can be shown readily and the debit and credit to the various accounts effected automatically.

1. Inventory at beginning of period.
2. Inventory at end of period.
3. Production during the month.
4. Shipments current month and to date.
5. Unfilled orders.
6. Cost of inventory at hand.
7. Cost of shipments.

If the various cards used as a part of the other systems mentioned are properly designed with the status plan in mind, it requires merely a sorting operation by item to bring them all into control so that the status report can be tabulated and the debits and credits made automatically. This report serves not only to give a complete picture of stocks and work-in-process but also should be a means of guiding the placing of manufacturing orders. Similar status reports can be developed for any type of business.

Chain Grocers

One of the most widely known examples of the use of the unit card method for inventory and billing is that found in the chain grocery field. In this industry, the problem centers around the maintenance of an adequate stock of merchandise in standard case lots for shipment to stores, with the maintenance of a central warehouse inventory at the lowest point practicable with the prompt replenishment of store stock.

All types of groceries can be put in standard shipping units and cards prepared for each of these shipping units or multiples of them. For instance, we may have a card for a one-pound bag of flour or a card for a five-pound bag of flour. The card used is one which will spell out the name of the commodity by either the use of the alphabetical tabulator or the substitution of alphabetical type for numerical type. For reasons of economy, and increased speed in tabulating, chain grocers generally do not seem to have availed themselves of the alphabetical tabulator.

Through study of the frequency with which each letter appears in the various products a simplified spelling plan is determined for each user and the selected letters for each position substituted for the regular numeric type. Experience has shown that simplified spelling for the chain store has produced a record readily readable by the average clerk.

The card itself is originated by the creation of a master card which is prepared showing the simplified spelling, the retail price, the description and the standard cost. It is frequently necessary to change these costs with each new lot of merchandise received.

Using the merchandise card either in connection with the duplicating punch or the gang-punch, a sufficient number of unit cards will be punched to cover the number of cases received on a receiving memorandum. At the same time that the cards are punched they are serially numbered so that later when these cards are placed in inventory tubs, it is possible to determine the stock on hand merely by subtracting the first and last serial numbers. A record of these serial numbers must be kept on the master card so that each new lot received will take the next highest serial number for that commodity. The cards are filed in inventory tubs horizontally in compartments holding two thousand to three thousand cards in each compartment, with fourteen to eighteen compartments to a tub. Aluminum guides are used for each of the packs and the cards made accessible for rapid pulling through the insertion of one to three small wooden blocks about one-half the height of the cards and three-eighths of an inch in thickness. Without these blocks, rapid pulling is impossible. With properly designed tubs, operating under correct conditions, a clerk can pull four thousand to five thousand cards a day.

All items should be arranged in the tubs in the same sequence as the merchandise is stored in the warehouse which should also be the same sequence in which it is kept in the stores and shown on the store order. It has been found of considerable advantage to use a printed store order form showing standard packing and the name of each item. Not only does it facilitate rapid pulling of the cards to have them listed on the order in correct sequence but it also tends to reduce materially the number of special orders through failure of the store manager to order all stock he may need. Despite the apparent advantages in using a blank order form which permits using a copy of the order as an invoice which some companies still continue to do, the experience of the companies using the printed order form contrasts very favorably as against the other method. The commodity code number used on this

order form should be a scientifically arranged number which will classify the cards in the sorter by profit classes.

Upon receipt of this order, the clerks at the first tub will select, using the first section of the order, the cards called for on the order, while at the same time cards for similar sections, probably corresponding to other floors of the warehouse, are being selected by other clerks. The whole order is assembled and sent to the punch where store number and street address cards are collated with the other cards. There are many commodities such as eggs, vegetables, etc., in which price changes occur so that special provision must be made to take care of this. The cards are inserted in the tabulator and an invoice written in duplicate, one copy of which is used to select the merchandise and the other retained as the office copy. Due to the fact that the items are listed in warehouse sequence, no back-tracking will be required to select the goods. The entire procedure of stock-keeping, warehousing and assembly of merchandise has a very important bearing on the success of the system and must be given considerable thought. Needless to say, these same factors also have an important bearing on the degree of successful warehouse operation.

A copy of the invoice or receiving slip will be returned by the driver indicating the acknowledgment by the store manager that the merchandise has been received in good order.

Minimum cards will be inserted in the "inventory file at minimum points so that as the clerks pull the cards from the back of each pack, the minimum cards will drop out. These are sent to the merchandise department for re-ordering. The whole procedure should be very carefully laid out. It will not, however, be included as a part of this pamphlet which deals primarily with the card procedure.

There are many variations in this method due to direct shipment of goods from vendors to stores, etc. All transfers, however, are handled through the store ledger system which effects debits and credits by major commodity classification, covering also by this method, direct shipments to stores and price reductions. The use of this method results in the preparation of the store audit sheets, the store ledger and the complete analysis of commodity by profit classification. These two plans, namely, the

unit inventory and ledger system comprise the bulk of the records required for chain grocery operation.

It should be emphasized that the installation of a unit card and billing method in chain stores, whether it be shoes, grocery, etc., requires a most careful analysis of the operating procedure involved and common sense dictates that but a small phase of the operations should be undertaken at any one time. The actual card design of the card system is the smallest part of the task while the installation of it is a painstaking job which is usually under-estimated. Through a pre-conceived idea of arranging a sort of acid test, many chain stores insist in taking the largest departments first or in taking the entire bite at once. It must be remembered that this method controls the physical operation of the business and depends for success upon the synchronization, not only of the card system itself, but your complete coordination of the organization with correct operating procedure and with the disturbing factors eliminated. There must be a thorough understanding on the part of everybody whom it affects, as to its purpose and functioning.

Retail Store Routine

Purchases and Accounts Payable. A copy of the order sent to the vendor will be used as a basis for punching a card which is used as a record of outstanding orders. These cards contain a vendor's code number assigned from the alphabetical numerical code. A term file, either in the form of visible index cards or an addressograph plate, will be made for each vendor. In case the addressograph plate is used, it will be utilized to place the name of the vendor on the voucher check instead of writing it by the typewriter. The purpose of the term file is the maintenance of an official statement of the terms in effect between the store and vendor and shows the following information: vendor's name and address, vendor's code number, department and terms.

The cards which have been punched for each vendor's invoice are filed vertically with standard index guides, first by department, by manufacturer and in order number sequence under manufacturer.

An approval apron should be made out in the receiving department by a receiving agent and used as a basis for punching two

cards, one to be filed in the purchasing or "outstanding order" file as a credit and the other to serve as a basis of the accounts payable system. The duplicate copy of the card, prepared from the receiving apron, will be sorted to department, manufacturer and order number and used to tabulate a daily departmental record of purchases received. These cards then will be sorted to due-date within each department and a daily sheet tabulated in duplicate, the original copy of this report being given to the order checking department where it will be attached to invoices as they are forwarded to the merchandising and checking division. The duplicate copy of the due date report, together with the cards and invoices, will be forwarded to the accounts payable department to become part of the accounts payable system. These cards have been punched with the following information:

Vendor
Invoice Date
Store
Department
Gross Amount
Discount Rate
Amount of Discount
Net Amount
Retail Value

Similar cards are punched for credits and returns to vendors. These cards will be filed in due date order within the department and the invoices placed in a separate file in the same order. As invoices are received in the accounts payable department, cards will be withdrawn from the file and the corresponding items checked off on the due date report.

At any time these cards, which are filed in the "due date" file, can be tabulated for a report showing outstanding obligations by due date. At the end of the week, the due date files can be tabulated, using certain specific dates, to form a report of missing or delayed invoices. This report can be made for each department, showing delayed invoices for the buyer's information but a similar report can be prepared classified by merchandise classification showing the total missing or delayed invoices in the jurisdiction of each merchandise manager.

As soon as approved, invoices are returned to the accounts payable department, and cards will be withdrawn from the file and used as a means of tabulation of the voucher check. The cards are placed in the tabulator so that it will automatically stop when the code number changes, enabling the operator to insert a new voucher check. Each invoice is listed on the upper part of the voucher showing the gross amount, discount rate, discount amount and the net amount. Totals for each of these three amounts are printed at the end of the list. The credit cards are listed and their total printed, the deduction made and the net amount printed. The name and address are printed by typewriting or addressograph plates or alphabetical name cards. Space is provided for protectographing the amount and a signature can be inserted with the signograph, after which the vouchers are ready for mailing to the vendor. (See page 1439.)

The cards are punched for each check showing the following information: vendor, voucher number, check number and amount. The cards are listed by check number to form a check register and a form of record for cash distribution.

These cards are then filed by check number where they remain until the cancelled checks are returned from the bank at which time they are withdrawn and used to verify the bank statement. The cards remaining in the file represent the total value of outstanding checks. The cards used for tabulation of the voucher register checks can be used daily, weekly or monthly, for tabulation of purchases from vendors including analysis by manufacturers, colors, style, price, etc.

The credit cards, previously mentioned as being used in connection with the voucher checks, are punched up from a copy of returned-to-vendor sheet and are listed in the next subsequent voucher for each vendor and their total amount deducted from the total amount of the voucher. The original copy of the returned-to-vendor sheet accompanies the merchandise to account for its arrival and to serve as a notice that this valuation will be deducted as described. These cards are sorted by stores and departments monthly and used to credit the store with the item in question.

Store Status. The card system is admirably suited to maintain a complete status system of all store operations. This in-

cludes the following general transactions and the maintenance of both sales and purchase budgets.

1. Outstanding Balance of Sales Budget
2. Outstanding Balance of Purchase Budget or open to buy.
3. New Appropriations
4. Cancelled Purchases
5. Transfers Out
6. Merchandise Returned to Vendor
7. Adjustments to Purchase Budget
8. Outstanding Purchase Orders
9. Transfers Out
10. Receipts to stock from vendors
11. Merchandise received and invoices not passed
12. Mark-up
13. Merchandise returned to customer
14. Cancellation of mark-down
15. Sales
16. Mark-downs
17. New Sales Quotas
18. Consigned Goods Receipts
19. Consigned Goods Sales

The debits and credits to these various accounts are effected by status cards which are made as daily summaries of each type of transaction affecting a status account. For example, summary of the purchase cards, in the outstanding purchase file, will be used to credit the purchase budget while a summary of the voucher cards will be used to debit stock and a summary of the sales audit cards created under a procedure described previously, will be used to effect credits to stock and to reduce the outstanding sales budget. These cards can be tabulated to produce departmental stock status reports showing the following information:

1. Department or Merchandise Class
2. Last Inventory at retail
3. Outstanding stock at retail
4. Outstanding orders
5. Purchases at cost and retail
6. Outstanding Purchase Budgets
7. Mark-downs

The same cards also can be tabulated for departmental sales status showing the following information:

1. Department or Merchandise class
2. Inventory at retail
3. Outstanding Sales Budgets
4. Current Month Sales this year and last year
5. To date sales this year and last year
6. Number of sales transactions

In another section of this pamphlet has been outlined a procedure for maintaining a unit inventory control on cards, for unit items such as garments, etc.

It is also advisable in some instances to operate the same type of status system for such classifications of merchandise as garments, following the plan outlined for the total store or business. Space has not been taken to outline the detailed procedure involved. As a result, however, a merchandise control report can be run for each style of goods or garments arranged by manufacturer, color, price and size to show the status as follows:

1. On Order
2. Purchase
3. Sold
4. Mark-down
5. On Hand

Furniture. Another application of the unit card system for retail stores, which functions exceedingly well is that applying to furniture. Two cards are punched at the time the order is placed for furniture, one being the record of outstanding orders and is filed in the furniture office and classified by manufacturer, style, price range, etc. The duplicate card will be forwarded to the warehouse receiving department and filed in a similar manner. Upon receipt, the warehouse clerk will extract the corresponding cards which will be tabulated to show the purchases received, by classification, and forward the record to the warehouse stock clerk to be used as a record of space to be provided for later, after which it is forwarded to the warehouse superintendent, after stocking, to be used as a control of finished or unfinished work. The cards will then be sent to the furniture office where the duplicates will

be withdrawn from the outstanding order file and both cards punched with invoice number, being then re-filed in the stock-on-hand file. At the time of sale, punched cards can be withdrawn from the file, using a copy of the sales check. These cards are then punched with the sales check number, the route number and the customer, and the date of promised delivery as well as the amount. The cards are next separated, the original cards being used to prepare several daily reports showing the sales by class of stock and sales person for the use of the furniture buyer.

The duplicate cards will be sorted to delivery date and tabulated for the warehouse manager. The cards will then be sorted to route order under delivery date and a report tabulated showing the volume of work on each delivery route in each delivery day, which copy is posted on the delivery platform on the respective date of delivery. At the end of the day, this list is used to check broken delivery promises and any special action taken which may be necessary. Cards will then be sorted to sales check number and the necessary orders for the workshop tabulated. The duplicate cards will be forwarded to the warehouse, the original card being filed by delivery date in the adjustment department.

The warehouse office receives a copy of the tabulated report of all sales orders and the cards which made it. After the order has passed through the various stages of warehouse operation and reached the delivery platform, the cards will be detached from the delivery sales receipts and tabulated to make route sheets for the driver to show the merchandise to be taken out on the trip.

Since the original cards were attached to the adjustment copy of the sales order, it is possible to prepare each day a report of complaints and their causes for the use of the furniture buyer.

Sales Audit Routine. Perhaps the most widespread application of punched cards in department stores up to this time has been the use of this method for sales audit. In comparison with many other desirable applications which could be made, sales audit perhaps produces the least results of all and has been responsible for keeping department stores from making real progress toward commendable applications. The following procedure outlines a sales audit method and indicates the results obtained.

1. *Cash Sales*
   For each sales check received from the cashier, a sales card will be punched, verified and used to secure the total cash recorded on sales checks and balanced for total cash.

2. *Cash Register and Certograph*
   A sales card of a different color will be punched for the sales of each clerk as shown by the cash register envelope and a check list run to determine the accuracy of punching in accordance with the cash register reading or tapes. The cards for cash sales or cash register slips will be filed until cards representing C. O. D. and charge sales are also filed.

3. *C. O. D.*
   C. O. D. Sales cards will be made up from copies of the C. O. D. checks attached to drivers' sheets representing the current date deliveries. These checks will be in route order and this order will not be disturbed. The check list to verify the accuracy of punching in effect will be a duplicate of the driver's sheet and will represent the total of monies to be collected from the driver upon his return. The check list may be used as a basis of paying in by the cashier or may be given to the driver as a record for cash collected or packages returned. The sales cards will then be filed with the cash cards.

4. *Charge Procedure*
   Cards will be prepared for each charge check received from the credit department. If these checks are separated by ledgers divided according to authorization, the check list used to determine the accuracy of the punching may also be used as a predetermined control of postings to be made to the charge account bookkeeping department. If these checks are not so sorted in the credit department, it is a comparatively simple matter to sort the punched cards and prepare this predetermined ledger control. These cards will be filed with cash and C. O. D. cards.

   The same procedure will be used in handling returned sales although they will not be filed with the others until after the gross sales are calculated. This is necessary on one hand for statistical purposes and on the other so as not to disturb the check number sequence for index purposes.

The holding file, now containing all kinds of sales cards, will then be sorted by check number, book, sales person and department, these cards being tabulated in detail to show each sale. The reports may be made in duplicate, one copy being given to the clerks auditing the index envelopes to determine missing checks and the other used as a daily report of each sales person made for the purpose of preparing commission records.

Unit Control for Ready to Wear Garments. This method is used to maintain a perpetual inventory of items on hand, to check the accuracy of the bookkeeping department and finally to obtain an analysis of merchandise turnover for the merchandising departments. Whatever happens to the merchandise as it moves through the store must be recorded on the corresponding card in the file. It is probably unnecessary to emphasize the fact that every method discussed in a pamphlet of this kind is exceedingly general in character and cannot be applied verbatim without adaptation to the specific requirements of each individual store.

A copy of the purchase order is used as a basis for the punching of a card showing such information as order number, vendor number, style, department, class, size, color, cost and retail. These cards are placed in an "on-order" file to await the arrival of the merchandise. In addition to the information just mentioned, the cards should also contain fields with the cost, selling price, markdown, serial number, etc.

When the merchandise is received, the checker will write out a record sheet after which, in the marking room, a voucher price tag is made out and marked with a serial number which corresponds with the serial number in the contract book. This serial number is stamped in the upper and lower portion of the price tag. Using this sheet, cards will be withdrawn from the "on order" file to cover all items indicated by the order number as being received and the serial number punched in the card. These cards are then placed in the stock file and arranged by department and serial number.

The sales clerk in making a sale will take the following steps:

1. Write the serial number of the price tag on the sales check.
2. Place the sales check number and date on both the upper and lower portion of the price tags.

3. Tear off price tag stub and drop into departmental stub box.
4. Write the identification of the articles sold such as the serial number, vendor, style, etc., on the sales summary.

The summary and stubs are collected and audited against each other to determine that all are present and accounted for, after which the stubs are used as a means of pulling the corresponding cards from the tub file and thereby effecting a credit to inventory.

In the case of merchandise returned by a customer for credit, the upper part of the price tag should also be returned and serve as a basis for the issuance of a credit slip. This merchandise is then routed through to the receiving department and treated exactly the same as new merchandise. Two cards are punched for each piece of merchandise returned; one card for stock file and the other card for credit analysis. Where the merchandise is to be returned to the vendor, the return-to-vendor sheet is made out in duplicate, showing serial number and full information concerning the goods, after which the proper cards are withdrawn from the inventory file for filing in the "return-to-vendor" file.

To effect a mark-down, the proper forms must be filled out, showing the old and new prices by serial number, the copy of this form being sent to the tabulating department where the mark-down and the date are punched in the proper cards, a new card being inserted to replace the previous one. This, of course, means the replacement of the price tag. The same procedure follows in the case of mark-ups.

Transfers should be effected through the means of a transfer form and the use of a new price tag with a new serial number, causing the old cards in the inventory file to be replaced by new ones.

In taking the semi-annual inventory, two clerks will work together, one calling off the serial number on the price tag and the second one recording it on the inventory sheet. These sheets are then audited with the inventory files and the identification checked. If it is desired, a test inventory can be taken periodically in specific departments or lines of goods to check losses.

There are various reports which can be obtained as an aid to merchandising. Some of the data included in these reports follows:

1. Vendor and style
2. Vendor and clerk
3. Class and style
4. Class and style as well as retail and size
5. Retail by sizes and colors
6. Sizes and colors
7. Vendors by total cost and total retail.

Weekly or monthly gross profit reports can be obtained if desired and similar data secured for analysis of mark-up and mark-down and returns to vendor.

Packing House Procedure

The following plan is one which happens to have been applied to packing houses and has been included as an interesting application in this field. Three special record fields are covered, namely:

1. Claim Statistics
2. Sales Accounting
3. Mileage Statistics.

Claim Statistics. The cards used for this purpose contain columns such as: territory, including district and route, produce, weight, amount, responsibility for returns, distribution, item counter, claim file number and credit amount. This card is created from a claim report and is used to tabulate the following classes of reports:

(1) Report of claim losses allowed compared to business volume, showing data as to quantity and amount of order and sales compared to claim losses by salesmen.

(2) Responsibility for returns with reason and responsibility for losses and allowances, including number, amount and per cent of each class to total.

(3) Departmental analysis of claims and allowances showing comparison of month this year with same month last year—run complete from cards for both years.

(4) Report of claim losses allowed compared to business volume, showing quantity and amount of orders and sales compared to claim losses by selling channel.

Sales Statistics. The dock copy of the invoice must be coded

for product class, after which a card is punched for each item for the following information;

1. District
2. Route
3. Product
4. Weight
5. Amount
6. Gross distribution loss
7. Gross distribution margin
8. Counter
9. Number of items per invoice

These cards are tabulated daily by classes of products, such as dressed beef, beef trimmings, hides, edible tallow, oleo oil and stock, beef casing, etc., showing weight, amount, gross sales, distribution, profit margin or distribution loss margin.

Weekly reports can be tabulated showing salesman's sales by product. From this report master cards can be punched, if desired, for use in tabulation of reports monthly by salesmen by products for gross profit. From these reports, master cards can be made for the purpose of running analyses of direct sales expense in comparison to sales effort.

Premium Accounting and Statistics—Life Insurance

Life Insurance. The use of punched card methods for various types of insurance records has been very extensive. Very few insurance companies now attempt the work other than by punched card methods. While there are many plans in use, the following may be taken as typical.

When a policy is issued, an addressograph plate is made covering the name of insured, agency number, plan code, date effective, amount of insurance, policy number, rate, method of payment, state, entry age, date of maturity or explanation of the present paying rate period, etc. After plate is made, distribution cards are addressographed and then punched for data similar to the following; Name, reference, policy number, state, life gross, disability gross, life net, disability net.

After the end of the first year, a new set of premium distribution cards probably will be required because of the fact that classi-

fication changes from the first year status to renewal and frequently the net rate changes.

The collectors' monthly report is printed from the addressograph plates and the tabulating cards checked against the report, all cards which match being sorted to first year and renewals and the distribution report tabulated to show; under first year, first and second year renewals, the gross life and disability and the net life and disability. The cards are re-sorted alphabetically and returned to the auditing department with the premium distribution sheet. This sheet is cross-footed and checked against the number of items on the collection report and the totals transferred to that report. The collection report is sent to the collector for action. When it is returned, it is checked against remittances and changes required made on the distribution sheet, the totals being transferred to a distribution ticket which serves as a means of posting the cash income and journal sheet. The premium distribution sheet is also used for posting net rates to the memo ledger accounts. The distribution ticket is then used as a basis for the punching of the cash income journal card containing the following information; date, state, class, reference, cash received, amount number, debit and credit.

These cards are run at the end of the month by account number and posted to ledgers after which they are tabulated for each premium account by states and the results posted to the status ledger. The cards are then arranged by agencies by policies to facilitate the pulling of cards to match the items on the agent's weekly collection sheet. The procedure followed from this point is similar to that outlined for the collection report. The handling of the cards from this point on will vary greatly and therefore has been omitted.

Another plan dealing with practically the same problem has been outlined as follows. The agencies send in a new business collection report showing,

1. Policy number
2. Name of insured
3. Amount of policy
4. Amount of premium

5. Commission
6. Cash remitted

From this report the office ditto card is selected and posted, the entries being audited and only the totals posted to the cash journals, thereby materially reducing the number of entries required.

These home office cards for each item contain the following information;

1. Year of issue
2. State of residence of insured
3. Agents code
4. Policy number
5. Commission
6. Amount of insurance
7. Total gross premium
8. Double indemnity premiums

The first set of cards serves to take off the agency statistics on paid for business to break income by states and by life, disability and double indemnity, into years of issue, including re-insurance volume and premium income. The second set is issued for progress records.

About thirty days before the renewal premiums are needed, a quadruplicate notice slip is addressographed. One copy of this notice is removed from the cashier's file when the premium is returned to the office and used to punch a premium paid card. At the end of the month, these cards are used to tabulate a cash settlement report as follows;

1. Policy number
2. How paid
3. Amount of premium
4. Date of premium
5. General agent's number

This report is used to credit renewal commissions as a basis of picking out from the permanent punched card file the corresponding renewal commission cards, checking the actual premium with that on the card. Renewal commission statements then are prepared in duplicate.

After the preparation of this report, the cards are tabulated to show gross, disability and double indemnity premiums by state, a

separate tabulation of reinsurance premiums being made, after which the cards are tabulated by agency and year of issuance.

This second method is somewhat similar to the first one outlined for premiums but has been included because of somewhat novel features.

Group Valuation. A tabulating card is punched for each policy issued; the card containing the following data:

1. Policy number
2. Agency
3. State
4. Maturity or expiration
5. Year of issue
6. Kind
7. Age
8. Policy
9. Amount
10. Premium
11. Net premium
12. Deferred premium
13. Payable
14. Termination or change

At the end of the week, these cards are sorted to valuation order for a report showing the policies and amounts in each group and a grand total to be checked against the week's figure of the policy department. From this statement, a summary card is punched as follows;

1. Change
2. Year of issue
3. Kind
4. Age
5. Policies
6. Amount
7. Factor

Revival notices are used to pull cards from the file of termination cards. These revival cards are then placed in valuation order and a report run similar to that for issues, followed by the creation of a summary card.

Termination notices are utilized to extract terminations from the active file, after which these cards are punched with method of termination and, at the end of the week, tabulated for a report of terminations, the number of policies and the amount of insurance having been punched in complement. The total obtained from the statement plus the total obtained from the cards should equal zero. Changes are effected in files as they occur and must be included in reports.

All of the summary cards which have been created are tabulated monthly for a report of insurance in force in each group. All groups showing a change card printing require a new summary card for the following month. On the final statement of the year, the reserve factor will be entered against each group. This can be done by the tabulator by inclusion of a special set of cards each year. The use of digiting (see Appendix) provides the reserve liability very simply.

Loans Against Life Insurance Policies. The reader may have had occasion to borrow money from an insurance company using his policy as security and in doing so may have felt that he was more or less unique in going to this dire extremity. A visit to one of the large insurance companies to see the voluminous records kept for this phase of the business, loans to policy holders, would be all that is required to disillusion him. The handling of loans transactions is conducted very efficiently, using punched card methods as indicated following.

Upon receipt of a proposed approved loan application, an addressograph plate is prepared and filed in a roster file, this file set up first by agents and sub-divided into anniversary months (the month of the first premium payable), and further sub-divided by time of payment such as annual, semi-annual or quarterly. Another method provides for the arrangement of the stencil file into twenty-one subdivisions, the first twelve being the months for annual payment, and the next six by combination for months by semi-annual payment dates and the next three by combination of months for quarterly payment.

Only one signal will be required to indicate the interest date, due to the fact that this occurs but once a year. Before the plate is put away in the roster file, it will be used to add two tabulating cards, one an interest card for interest statistics and the other a salesman's card to handle due dates. The interest card will be used to tabulate, at the end of the day or period, a report arranged by agency and state after which the interest cards may be filed for any desired period and then destroyed.

The sales card will be filed in a "prepared in advance" file by agency, by due date and by month of interest. By a sorting operation, the loan card representing the interest due during the cur-

rent month, is automatically thrown out and made available for running through the tabulator for the tabulation of a notice slip. This slip is made up in sets of six notices on a strip with perforations between. The use of a punched card for the running of loan notices rather than the stencil is due to the fact that a part payment necessitates a change in the amount of interest due from period to period. All notices are then separated and stencilled by the roster file stencils, the original being sent out as a notice of interest to be paid and the duplicate held until payment is made, at which time this can be mailed out as a receipt. After printing the loan notice, the tabulating cards are re-run on a triplicate summary list showing the interest due for each agency, one copy of this report being retained in the home office as a record of notices issued and the other two copies being mailed to the agency, one of which the agency returns with the notation as to the unpaid interest.

The cards used to print the notices are then arranged by date of the month in which the interest is due and as payments are received the cards are removed from the tickler file. The corresponding stencils are removed by means of the tabulator and the stencil machine receipts are issued. The balance of the cards remaining after the due date are used with the balance of the stencils to run off over-due notices.

As a payment of interest or partial repayment of the loan is made, the sales cards will be removed from the file, using the return notices as an authorization for this action and at the same time the corresponding plate in the loan roster file is also removed. Except where full payment is made, a new card for the next due date must be prepared, by punching a new interest card for the unpaid balance of the loan and the interest due at the time of payment. The old interest card is punched only when a partial or complete payment is made.

The original interest cards are run through the tabulator and a loan receipt form prepared in a manner similar to that outlined for interest notices and addressographed with the proper stencil, after which the summary sheet is made and forwarded to the agency. A paid interest card is run daily to show receipts of new

loan payments and interest received and the status of renewed loans.

The new card representing the loan and interest due after the payment of interest or any payments of installments in the reduction of the loan can be tabulated for a special report and when this is done, these cards will be filed in the "prepared in advance" file from which the old interest cards were withdrawn. At the same time that the interest cards are filed, the loan clerk will post the amount of the loan interest on the loan card.

Conclusion. Various plans relating to punched card methods have been discussed generally and also specifically with relation to a few individual industries. It is perhaps desirable to present again the fundamental principles to be considered in connection with planning the installation of a successful punched card method in order that they may be firmly fixed in mind.

(1) A general knowledge of the various record activities and the purposes for which they are conducted.

(2) A synchronization of the record plan so that the relation may be seen between one branch of records and another which logically should be a direct outgrowth.

(3) A standardization of practice and plans for handling regular transactions and also regular ways for handling exceptions.

(4) The design of proper and simple codes.

(5) The design of tabulating cards for multiple purposes synchronized so that different cards created for different purposes can be tabulated together.

(6) The elimination of all decoding and the planning of the system so that reports are rendered in finished form for executive use, with the names where necessary, and providing for two-year comparisons where desirable, both for current month and to-date figures including as well, comparison against budgets or standards.

(7) The designs of proper controls and a control sheet.

(8) The determination of type of equipment best suited to requirements.

(9) Provision for an executive capable of analyzing results when obtained.

(10) Provision for installation under methods which will insure successful installation under supervision capable of carrying out

the program of successful installation and contending with operating difficulties as they arise with the necessary authorization to get into matters which relate to the various departments affected.

The various illustrations given of methods and applications are not such as can be applied specifically to any one business nor is it possible to design such an application without facts pertaining to that specific business at hand. The reader is cautioned therefore against construing any of these methods as being applicable to his own business until he has gone all through the steps outlined in the Appendix as preliminary to the design of an effective tabulating system.

The machine designs and specifications which follow have not been prepared under authorization by the manufacturers making these machines but represent only the writer's observation in an attempt to present the fundamental features so that an executive may get a better understanding of this method and what he can do with the different types of equipment. If any of these specifications relating to equipment seem biased or incomplete, it is quite unintentional, since the writer has attempted a difficult task of presenting the subject with fairness and to give the exact data such as he sees it, which data ordinarily can be secured only with considerable effort by the executive, handicapped as he is by his lack of familiarity with the equipment and hence unable to ask questions which bring out the pertinent information which he seeks. If this pamphlet succeeds in clarifying this subject, it will have been worth the effort.

APPENDIX

FORM 1

Punched Cards and How They Work. For those who are interested in the detailed steps of laying out a system of punched card accounting, it seems desirable to present a picture of what a punched card actually looks like, what it means, and how it is able, when inserted in the various machines, to produce results to be outlined subsequently in this pamphlet.

Form No. 1 illustrates the first type of punched card form, stripped of all specification applying to any individual job. The first of these forms has forty-five columns horizontally and shows vertically digits ranging from zero to nine in each of the forty-five columns. Cards of this character may be used in all of the tabulating machines now on the market.

On form No. 1, the eleventh and twelfth positions may also be used, being punched directly above the tenth or zero positions, to increase the capacity of the particular columns where used.

If, for example, it is desired to place in the card an invoice number of four figures, we will rule off, let us say, columns eight to eleven inclusive, and label these with the heading "Invoice Number". If we want to show an invoice number such as 4,911, the four will be punched in column eight, the nine in column nine and the one in each of columns ten and eleven. On form No. 1, where we are able to use the eleventh and twelfth positions, if we wanted to use a series of invoice numbers exceeding 9,999, we could do so by using the eleventh and twelfth positions on top of the cards which would give a capacity for the use of a series of invoice numbers up to 29,000, still using only four columns of the card. This latter procedure means that column eight would not only be punched for the fourth digit of the invoice number but also for the fifth digit, the latter being punched in either the eleventh or twelfth position for one or two for the series of invoice numbers ranging from 10,000 to 29,000.

There is a second type of card, illustrated as form No. 2 which, instead of having only forty-five columns horizontally across the card, has eighty columns horizontally, each one of which occupies only approximately one-half of the space required in each column of the forty-five column card. This card can be punched in the eleventh and twelfth positions and can be sorted or controlled from these fields but not tabulated from them. Of course this card

FORM 2

has increased capacity because of the number of columns available horizontally. This type of card can only be used in electrical eighty card column machines and not in the forty-five column machines.

Each of these cards is the same size, being three and one-quarter inches in width and seven and three-eighth inches in length. They are procurable only from companies which make the machines because they must be of exact size and thickness and also because of the clause in the lease under which the machine manufacturer leases the machines to the user.

There is still a third type of card, illustrated here as Form No. 3, which can be used in conjunction with the forty-five column card and also has punching capacity in the eleventh and twelfth positions on each card. This card provides twenty columns horizontally of alphabetical type, each column of which is punched with two holes in one of the punches to be described subsequently. This card has twenty-three letters of the alphabet in each of the twenty columns, the "U and V", the "X and Z" and the "O and Q", being doubled up. The feature of these cards is, therefore, that in one column, we have the possibility of punching any letter of the alphabet in what would appear to be only nine or ten punching fields. These cards therefore, can reproduce a name, not exceeding twenty letters or any part of twenty letters, in exactly the same way as though the name were typed on the ordinary typewriter.

Form No. 4 illustrates a numeric card, such as is used for chain grocers, from which the numeric type has been removed from columns eleven through thirty-two and alphabetical type inserted in its place. The selecting of the alphabetical type has been based upon a study of the names to be printed, having in mind making the resulting simplified spelling readable by the layman, in this case, a store clerk. The use of this card was further discussed under the subject of chain grocers.

In connection with the mechanically operated tabulator, it is understood that a ninety column card is procurable.

These cards, while they are ordinarily presented covered with figures printed from zero to nine in each of the forty-five or eighty columns, should be regarded by executives as ordinary pieces of paper, from which all printing, relating to actual figures

DESCRIPTION
Date
Mo. Yr.
Quantity
Account No.
Dept
Sub Acct.
Amount
Reference No.
Printed U.S.A.

FORM 3

1435

QUANTITY PER UNIT
SIZE
DESCRIPTION
WHOLESALE PRICE
CODE NO.
UNIT
WHOLESALE EXTENSION
JOBBING PRICE
JOBBING EXTENSION
COST
WEIGHT
CLASS
SALESMAN NO.
DISTRICT
CUSTOMER NO.
DAY OF YEAR NO.
LICENSED FOR USE UNDER PATENT 1,772,492

FORM 4

to be punched, can be removed from the face of the card and the card itself printed with writing spaces to be used in the same manner as any other form on which written data ordinarily would be placed. This card is illustrated as Form No. 5. Strange as it may seem, though the card is covered with writing such as would appear on any form, if the card is properly designed, it is practical to use the card as an ordinary form and to completely punch it without destroying the legibility of the written information. Due to the physical construction of the punches, consideration must be given where the electric punch is used to the location of data which is to be punched in order that the information may be visible to the operator. In using the mechanical punch, the automatic model does not make for visability and hence the visible or single card feed machine must be used.

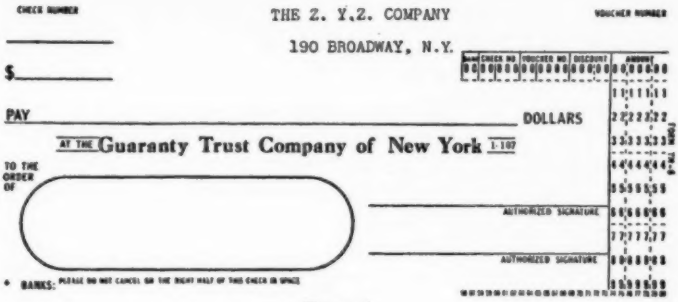
Punches. For cutting holes into the cards for the purpose of actuating selection by the sorting machine and interpretation through the use of the tabulator for addition, subtraction or designation, supplying other information through the medium of these holes, a punch of one type or another must be used. We have explained the punching of an invoice number. In order to punch this into the card, we must strike the keys bearing the numbers on the punch, 4, 9, 1, 1. All machines are equipped with keys ranging from zero through nine inclusive in addition to a space key or skip key which enables the operator to space or skip any number of columns desired, and also keys for the eleventh and twelfth positions.

The electric punches are provided with especially designed skip bars for different card designs. In using the mechanical punch, the cards are placed in a magazine in the front of the machine and the operator proceeds to set-up the information to be punched, from the original data. As the carriage of the machine moves over the columns from left to right, one column at a time and when the operator has finally completed the punching set-up, the trip key is pressed. This action sends the cards underneath the dies previously set-up through operation of the keys and causes all holes to be punched simultaneously, depositing cards in a magazine at the back of the punch.

This machine can be equipped, if desired, with a numbering or

NAME
DEPT. WORKED IN
STAMP TYPE ORDER HERE
NO. OF CARDS
CUSTOMER
FOREMAN
NO. OF SPOLS.
WOOL OR YARN
SHIPPING YARDS
MACHINE NO.
MAP WIDTH E OR J
LOT NO.
DAY OR NIGHT
DESIGN OR STYLE
COLOR
BALE NO. & FELT PIECE
NO. OF PIECES PICKS
LABOR CLASS
REMARKS
OPERATION
WARP NO.
TYPE OF ALLOW.
DATE
WOVEN WEIGHT
FINISHED YARDS SIZE
WEIGHT IN OR OUT LENGTH
ALLOWANCE
TOTAL
NO. OF SPOLS. ENDS WOVEN WGT.
FINISHED YARDS SIZE
EMPLOYE
DEPT. NO.
DEPT. WKD. IN
HOURS
ACT.
STAND.
WEIGHT LENGTH
AMOUNT
ALLOWANCE
STANDARD HOURS
ACTUAL HOURS
RATE P. W.
EST.
RATE D. W.
EST.
START
STOP
DAY
NIGHT

FORM 5



FORM 6

printing atachment which will describe a style or quality or print a number of three or four digits on the end of the card, at the same time numbering cards serially, to the extent of eight figures or specifications. The numbering attachment must be reset manually. If it is desired, the punch or trip key can be locked down and as many cards as desired run through, duplicating the same information at the rate of 110 cards per minute. A counter on the front of the punch enables the operator to determine the quantity punched. The second type of punch used in conjunction with the forty-five column card or with the eighty column card feeds in from the magazine at the right of the machines, operating the keys as previously described, except that in this instance, instead of the setting up of a die which finally results in punching all of the holes simultaneously, the holes are punched individually as the keys are touched. The cards are ejected at the left of the machine.

In the case of the cards to be used with the mechanically operated tabulator for alphabetical printing, use is made of an alphabetical punch. This punch has a key-board similar in design to a typewriter key-board electrically operated.

Where it is desired to duplicate the codes or the entire cards, a card containing information which it is desired to duplicate, is placed in the back of the machine and electrical contact causes the machines to feed the cards automatically from right to left and duplicate such portions as have been set up for duplication. The machine equipped for duplicating is slightly different in appearance than the straight punching machine.

NAME
NO.
AMOUNT
PAYROLL CARD
DO NOT BEND THIS CARD
RING YOUR TIME HERE
ACTUAL HRS
EMPLOYEE
MON.
TUES.
WED.
THUR.
FRI.
SAT.
RATE
AMOUNT

FORM 7

Sorters. In addition to punches, two other types of machines are necessary, namely, sorters and tabulators. The function of a sorter is to arrange the cards in whatever sequence may be desired for report purposes. Each sorter has a magazine on the top of the machine at the right end in which the cards are placed and is equipped underneath across the machine with pockets from one to twelve and a reject pocket. The field to be sorted, or, in other words, the column containing the headings of the reports wanted, is the guide for setting the sorting mechanism and the gage is moved over the column desired for selecting. This machine is equipped either with pins or electric contacts which actuate the sorter to throw the cards into the various pockets by contacting with the holes in the cards. If there is a hole in the column in question, the device controlling the proper pocket is actuated and the card dropped into the pocket as it moves across the top of the machine. The sorting operation means the running of the cards through the sorter as many times as there are columns to be sorted. For example, in the case of the invoice number of four digits punched in columns eight to eleven, all of the cards will be run through the sorter four separate times, perhaps starting with columns eleven then ten, etc., or beginning with columns eight and nine and working backward, according to the conditions found in each particular case resulting in the easiest sorting. The speed of the sorting operation is about 400 cards per minute.

If it is desired, counting attachments may be attached to each pocket to register the number of cards thrown into each pocket. An electric counting sorter has been developed which will, in addition to sorting cards, compile and print totals of the number of cards punched in each position of one, two or three columns. It is worth while giving considerable thought to the development of correct sorting methods, since the time saved will amply repay the effort.

Tabulators. The third type of machine is the tabulator. The cards feed into the tabulator from a hopper of the machine across the controlling mechanism to a stacker which receives the cards. It might be well to mention right at the start that one type of this machine operates entirely on the principle of mechanical actuation; (by pins going through the holes in the cards) while the other type

is operated electrically by a means of a brush going across the face of the cards and contacting with a chromium roll underneath, actuating the mechanism through electric circuits. There are several kinds of tabulators of which space does not permit a full description.

There are three principle classes of mechanically actuated tabulators, the first two of which differ in the number of designation or accumulation digits for report purposes. Each of the machines has at the top, type bars arranged in seven banks corresponding to seven adding machines, each bank having a capacity in one instance of $90,000,000.00, for accumulating purposes, and in the other for $9,000,000.00. All three of these mechanically operated tabulators are printing tabulators. Each field can be used for complete designating or accumulating purposes. In the one case, there are ten type bars per unit and in the other nine.

The third type of mechanically actuated tabulator differs from the two mentioned above largely in the fact that the first two units at the left end have been consolidated into one solid alphabetical unit with twenty-three letters on each type bar or sector as it is generally called.

The tabulators which are electrically actuated, of course, operate on different principles than those which were just mentioned. These tabulators are of three major classes, the first of which does not control a printing mechanism, being almost entirely used where rapid accumulation of totals is desired, which totals appear on the dials with registers in front of each counter on the machine. An operator reading these totals as they appear notes them on her report which is then typed. Its chief advantage is high speed, and it is used for direct posting to records where printed tabulations are not required, or where the form of the final report is such that it cannot be made on the printing tabulator.

The second type of this class of tabulator contains a printing mechanism and can actually reproduce figures accumulating from these cards directly on a report form. The only difference between the two machines is the fact that in the seven unit machines, the first and second units are for designating information. Each machine has five accumulating units.

The electrically actuated tabulator has eight columns which can

be wired, due to the fact that the last column to the right in each unit is a star which prints opposite totals and the last type bar to the left is used for accumulation purposes, not being directly wired. This, therefore, gives eight columns which may be directly wired, producing totals up to 9,000,000. The electrically actuated tabulators have an adding speed of 150-160 cards per minute and a detail listing speed of seventy to seventy-five cards per minute. The speed of the mechanical tabulator is approximately seventy-five cards per minute in either straight adding or listing.

Naturally, the time of printing totals affects the production speed of both the electric and mechanical tabulators. For example, in figuring the running time of any report made with the electrically operated tabulator, the figures are arrived at by taking the number of totals to be thrown and multiplying this by five, adding this figure to the original number of cards involved in the report and then dividing the total by 150 cards per minute. The following example (where there is no listing and cards are run for totals only) will illustrate this method for calculation.

40,000 Invoice Cards
10,000 Contract Cards
29,000 Miscellaneous Cards (1450 per day × 20 days)

79,000 Cards to run for report
15,000 (3000 totals × 5)

94,000 ÷ 150 cards per minute — running time of approximately eleven hours for one machine which, for purposes of estimating, we will extend to two days. This extra time allowance does not indicate actual running time, but factors of safety to allow for conditions of actual operation. In connection with the above, when items are to be listed, the divisor should be seventy-five instead of 150.

It is understood that an electrically actuated tabulating machine has been engineered and is in the process of manufacture which is capable of handling complete alphabetical printing direct from the punched card to the finished report.

There are many points to be considered in designing a tabu-

lating card for use with any tabulating method, the number being almost as great in variety as the number of applications to which they may be applied. There are two major differences between the two types of machines which should be borne in mind. The mechanically operated tabulator requires that a multiple translator be designed to govern the arrangement of interpretation of the card for report purposes or to govern the actuation of the printing mechanism. The translator is shaped on the bottom the exact size of a tabulating card and on top is spread out to the width of printing heads which, in this case, is seventeen and one-half inches.

These translators are equipped with wires which control printing and accumulation. It is usually necessary to have more than one of these boxes with each tabulator but in the main, two or three translators can be designed so as to take care of all possible reports which can be run from the cards. When a report requires a different translator, the first one is removed and the second translator is inserted in the tabulator in accordance with instructions governing the reports required. Considerable care must be taken in designing these translators to insure that they will provide for all requirements, since any alteration in them must be handled usually in the factory of the company making the machines.

In the case of the electrically actuated tabulator, the control printing and accumulation is accomplished as follows. In front of the machine there exists what amounts to a telephone switchboard equipped with plug wires which may be switched around and wired in from various locations on the card to the various printing and accumulation heads practically as may be desired. It is very necessary that instructions be issued to the operator governing this wiring operation since it entirely controls reports and must be changed for different runs.

The arrangement of individual tabulating cards as to their columular headings is too extensive to explain in detail due to the immense variety of arrangements required to cover all possible applications. It should be emphasized, however, that it is possible to place many kinds of information in the same field. For example card columns forty to forty-five might represent "finished stock balance" on one card, "production" on another and on a third "shipments to a customer". This information can be con-

trolled by wires or circuits so as to print on three different accumulating units and reflect the effect on the outstanding balance of finished stock of the debit to finished stock arising through the current month's production, as well as the credit to finished stock resulting from shipments to customer. Production can be accumulated for the month on a separate adding unit and shipments in still another head.

Another means of using different headings in the same columular fields but printing from different cards is found in the case where we might have printed on one card from columns forty to forty-five, a sales budget, on another, contract amount, and on still a third, shipments to date. This really means three kinds of information which may be printed in three different units of the machine from the same field on three different cards and all of them may be tabulated at the same time.

In other words, it is possible by means of controls, to have all of the information go into the left unit of, let us say, two units as well as to the right unit or to have it go to the left unit only or the right unit only. At the present time, the mechanically actuated tabulator can control three kinds of information although ordinarily not more than two are used. The electrically operated tabulator can satisfactorily control a four way split of information from the same fields in the card.

Complements. When it comes to the question of effecting net balance or showing net shipments, brought about by automatic subtraction of credits, the past practice has been to punch the credit figures in what is generally known as "complements", meaning that the credit is punched in the cards as the difference between the credit and 100. Let us say that the amount of the credit was $46.00 in which case this figure would be punched in the card as $54.00, preceded by the punching of nines to whatever extent is necessary to make up the number of figures corresponding to the number of the remaining accumulating units in the space on the cards, the balance of the sectors in the adding head being controlled on the electrically operated tabulator by a column for punching of the hole which can handle any number of nines or on the mechanical tabulator of a nine hole in top of the card for each two sectors left in the adding unit.

While this use of complements appears to be complicated, in actual practice operators gather sufficient experience in punching complements as to make errors very infrequent. The question of speed required to convert credits to complements becomes of secondary importance. In addition to the necessity of punching complements, it is usually essential to punch the positive amount of the credit for the accumulation of this figure directly, so that in many instances we are obliged to punch both the complement and the positive figure. Both types of tabulators are now being equipped for direct subtraction features. These types of machines will give direct subtraction without the use of complements and with only one punching of the credit information. In other words, to effect subtraction, it is only necessary to punch the true figures.

In connection with the preparation of reports, it should be pointed out that there are several styles of finished records which can be prepared for executive use.

1. *Numeric Classification Indication.* Where straight numeric indication is required, such as account numbers, part numbers, etc., the regular electric or mechanical machines are used without special arrangement.

2. *Numeric Alphabetic Indication.* Symbols or letters replacing the regular numeral type as illustrated by form No. 4 provides for reports on which the classification is shown by abbreviations or simplified spelling. Both types of tabulators can be equipped for this work.

3. *Reports With Pre-printed Classifications.* Through the use of forms with pre-printed descriptions for the various accounts or classifications, the regular numeric tabulators can be used to prepare finished reports. Through the use of master cards, the tabulated results are synchronized with pre-printed classifications.

4. *Strictly Alphabetical Reports.* Reports of a strictly alphabetical nature such as employees' names on payrolls or customers' names on sales analysis can also be secured. With the mechanical tabulator, specially punched alphabetic cards cause the machine to print the name at the time of listing each card or taking a total.

The electrically actuated tabulator eliminates decoding for names, etc., through the use of a synchronized stencil file with addressing machine as a separate operation. The advantage of the

two types of equipment from this standpoint must be determined in each specific application because there are many factors which have an important bearing in which the mere difference in finished report preparation is not the deciding factor.

In all instances, the width of reports depends upon the number of units used and the kind of tabulator, the mechanical tabulator requiring two and one-half inches per unit, including space between units, and the electrically operated tabulator one and seven-eighth inches per unit. The mechanically actuated tabulator usually has a twenty inch carriage while the electrical machine has a sheet width of twenty inch carriage. Four or five carbons may be used successfully if properly designed forms are used to keep them in place and maintain proper registration. Unfortunately, but few printers seem to understand this type of work and do it successfully. Where any considerable volume is involved, it will be found more economical to buy one time carbons already inserted, rather than to insert carbons by hand.

Where the number of copies required runs higher than four or five, the usual procedure is to utilize forms printed in hectograph ink and use a duplicator ribbon in the tabulator, running off the reports on some form of duplicating machine. Where a smaller report width is desired, it frequently will be found practical to compress a seventeen and one-half inch sheet by folding the original before duplicating to eliminate all spaces.

It should be stressed that one of the most important things to be considered when about to install a punched card method is to be certain that the design of the system is such that it will meet all requirements and will provide for expansion of the method through the development of a complete comprehensive plan which will permit the tabulation of all co-related cards which should logically be run together. One of the serious conditions found in many tabulating systems is the fact that one phase of work is desired when the system is installed and when the next phase is reached, it is found that the entire system must be re-designed unless a great deal of unnecessary motion is consumed in operation. It also should be remembered that one of the worst criticisms made against many punched card installations has been the fact that they do not deliver reports in finished form for executive use.

There is no excuse for any tabulating installation which puts reports in code, which require comptometer work for the inclusion of to date figures or comparisons with previous years, budgets or standards. There is practically no case where the reports designed for executives cannot be run off in finished form for use, completely typed, understandable and without performance of all last minute operations which are so characteristic of many installations.

Accuracy. The question of accuracy often arises in connection with the punched card method. Trained operators of the right type soon get so that their percentage of error in punching is decidedly small and clerks who do not develop the ability to punch accurately within a relatively short time under training should be removed from this work. In training operators, firm emphasis should be placed on accuracy with speed as a secondary consideration.

There are two general methods in use for checking the accuracy of the punching of the cards. The first of these contemplates the tabulation of a check list which is verified by item with the original source of the punching and the totals of the money involved balanced against a control figure. There is also available for use with the electrical machines a verifier, which operates on the principle of re-punching the cards and in that manner catching errors in punching through refusal of the machine to function. Where this device is used, the cards are run through the tabulating machine simply to secure a money total and to insure the fact that all cards are included.

An electrically actuated interpreter has been developed to print on the cards a reproduction of the information punched in the cards so that if it is desired, this means can be used to supply a record to check against the original source of the information. This is of considerable benefit to facilitate rapid pulling of cards from the "open" file. This machine also does away with one of the old reliable objections to punched cards, namely, that the reading of the holes was a difficult art. As a matter of fact, however, the reading of the holes never was and never will be a factor and where done at all is always performed by clerks fully capable of doing so.

In general, it may be said that the punching of cards can be

made an accurate operation. It may also be said that the operation of sorting and tabulating can also be made accurate. Suitable test cards can be provided to test every possible angle of a tabulator and if used prior to the starting of a day's work or a long report, should do much toward elimination of error due to improper functioning of the tabulator.

Under proper organization and planning, tabulating departments should be operated on a production basis under a definite schedule so that reports can be issued on time and under a definite plan which will not only insure the proper preparation of reports, but will produce them accurately and when required. Where these results do not follow, the trouble should be easy to locate.

Gang-Punching. The mechanical machines are provided with a gang-punch which is of use where it is desired to punch one card and then duplicate the card, either a few times or many times, as the case may be, without the use of a special machine for this purpose. In other words, the ordinary punch can be used for gang-punching.

The electrical machine includes a gang-punch which provides for the insertion of a code card resulting in the automatic gang-punching of the cards of all information which it is desired to repeat. This machine is of use where it is desired to reproduce quantities of cards without the necessity of setting up the first card individually in the punch. It contains a control device which can be set to stop the punch when the desired quantity has been punched and a numbering or printing attachment can be placed on the machine in a somewhat similar manner to that outlined for the mechanical gang-punching. The electrical gang-punch has a unique use through the insertion of a gang extension card under which method payroll cards, etc., having like rates and hours, may be sorted together and the extension punched into these cards through the gang-punch for similar rates or dollars.

Automatic Totalizing. Through the medium of a control device the tabulators automatically print the totals of each group of cards, re-set the adding mechanism and automatically proceed with the next group. There is considerable variance in connection with major, intermediate and minor control features which should be

taken into consideration with regard to the type of equipment and specific problems.

Progressive Digiting. The use of digiting for short cutting extension work where only the total extension or valuation is desired or where the valuation of large groups is required is little understood and it would therefore seem advisable to include an explanation of progressive digiting in this pamphlet.

500	Pieces	No. 1476 @	1.00 per H
1000	"	No. 932 @	1.00 per H
1500	"	No. 524 @	1.00 per H

We are not interested in the individual extension of each item for purposes of arriving at the total valuation. The ordinary prices in use in problems of this character are, of course, not as simple but this does not complicate the matter, due to the fact that there are only 10 different digits in the decimal system, and hence if the multiplicands are arranged in groups for each digit of the several columns of the multiplier, many extensions can be made in total by the use of digit sheets which are illustrated elsewhere. The Progressive Digit Method merely means multiplication by addition, that is to say, the quantities which are to be multiplied by nine are grouped together and added and those which are to be multiplied by eight are likewise grouped and added. The procedure is repeated down to the figure one. The detail method followed under progressive digiting is to secure the total tabulation of the quantity for the nine group and then the total of the nine and eight group, either as a combination total or securing the eight total separately and adding this to the nine total and so on down the line for the remainder of the groups, arriving in each case at a progressive total. This probably will be somewhat clearer if the illustration covering the manual, the old digit method and the progressive method as illustrated are reviewed.

This illustration shows how this plan functions in connection with tabulating. In the analysis of the nine group of the unit sort fifteen and twenty make up the first total of thirty-five and when the eight group is complete and the progressive total struck, this figure will include thirty-five as well as the total of the eight group and when the total at the end of the seven group is thrown up, it will again include thirty-five as well as the eight group which is

MANUAL INDIVIDUAL EXTENSION METHOD

50 x 47	2350 ⊕
55 x 16	880 ⊕
82 x 30	2460
19 x 15	285 *
46 x 12	552
49 x 20	980 *
30 x 41	1230
7 x 23	161
64 x 80	5120
91 x 3	273
36 x 10	360 †
73 x 8	584
28 x 50	1400 †
61 x 9	549
72 x 15	1080
83 x 30	2490
94 x 40	3760
5 x 39	195
16 x 40	640
27 x 50	1350
	26,719

* 15 + 20 = 35

† 10 + 50 = 60

⊕ 47 + 16 = 63

OLD DIGIT SHEET METHOD

0	Units	8 8	
	Tens	6 2 X	
	Total	7 0 8	X 0
1	Units	1 2	
	Tens	5 5 X	
	Total	5 6 2	X 1 = 562
2	Units	4 5	
	Tens	1 0 0 X	
	Total	1 0 4 5	X 2 = 2090
3	Units	3 8	
	Tens	5 1 X	
	Total	5 4 8	X 3 = 1644
4	Units	1 2 0	
	Tens	3 2 X	
	Total	4 4 0	X 4 = 1760
⊕5	Units	5 5	
	Tens	6 3 X	
	Total	6 8 5	X 5 = 3425
6	Units	5 2	
	Tens	8 9 X	
	Total	9 4 2	X 6 = 5652
7	Units	7 3	
	Tens	2 3 X	
	Total	3 0 3	X 7 = 2121
† 8	Units	6 0	
	Tens	6 0 X	
	Total	6 6 0	X 8 = 5280
* 9	Units	3 5	
	Tens	4 3 X	
	Total	4 6 5	X 9 = 4185
			26719

PROGRESSIVE DIGITING PLAN

Units	9	35	35 *
	8	60	95 †
	7	73	168
	6	52	220
	5	55	275
	4	120	395
	3	38	433
	2	45	478
	1	12	490
			2349
Tens	9	43	43
	8	60	103
	7	23	126
	6	89	215
	5	63	278 ⊕
	4	32	310
	3	51	361
	2	100	461
	1	55	516
			2430
			26719
Con-trol		86	578
		62	578

* Indicates method by which digit "9" of multiplier in unit column is carried to Old Digit Sheet Method and Progressive Digiting Plan.

† Indicates method by which digit "8" of multiplier in unit column is carried to Old Digit Sheet Method and Progressive Digiting Plan.

⊕ Indicates method by which digit "5" of multiplier in tens column is carried to Old Digit Sheet Method and Progressive Digiting Plan.

FIGURE 2

the ninety-five and the seven group, etc. The "O" being a negative is hence used for control purposes only and entered on the bottom of the sheet as shown in the illustration. In actual practice, it is not essential to print the individual group total but only the progressive totals. Missing digits of any sort can be guarded against in either of two methods, either by manual insertion of cards punched with the missing digits after inspection or the use of nine

pre-punched cards for the entire range of the cards covered by the number of sorts to be made in the multiple field.

Control Sheet. Every phase of punched card work must be tied in with the controls, not only to govern the daily balancing of work but also to serve as a means of balancing the various reports which may be run from these cards. This is necessary, regardless of whether the system applies to work-in-process, finished stock, or any other phase.

In order that this matter of balancing may be conducted efficiently and that proper control may be set-up for tieing in finished reports, it is very essential that a form of control sheet be devised on which the daily balances to the various accounts effected may be recorded in an orderly manner so that monthly totals may be computed. Considerable thought should be given to the designing of this control sheet in connection with the special purposes for which it is to be used. A tabulating department without a control sheet is like a ship without a rudder and gets about as far.

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